

ARS Battles Mad Cow, Scrapie, and Other TSEs

Long before mad cow disease began making news in Great Britain, ARS was a leader in research to safeguard livestock from this and other transmissible spongiform encephalopathies (TSEs), a group of diseases caused by abnormal proteins in the nervous system called prions. But there's no question that more attention has been focused on the topic since the first case of mad cow was diagnosed in the United States last December.

Technically referred to as bovine spongiform encephalopathy (BSE), mad cow disease is one of four known animal TSEs, and it poses a serious threat to the U.S. cattle industry. That first U.S. case resulted in a complete shutdown of cattle exports to several countries. The Japanese market was still closed when this issue went to press, despite the fact that the positive cow was of Canadian origin. The cost of such losses is staggering, as demonstrated by the 1986 outbreak of BSE in the United Kingdom, which at last report has cost European countries an estimated \$107 billion.

The USDA Animal and Plant Health Inspection Service's (APHIS) National Veterinary Services Laboratory (NVSL) confirmed the first U.S. BSE case. APHIS called on ARS's National Animal Disease Center in Ames, Iowa, to conduct confirmatory tests on the tissue samples and asked ARS's U.S. Meat Animal Research Center in Clay Center, Nebraska, to coordinate DNA testing and analysis to help trace the origin of the BSE-positive cow.

BSE is also a potential human health safety problem because laboratory animals and cows have become infected after eating specified risk materials, such as brain or spinal cord, from infected cows.

To safeguard livestock and people, the U.S. Department of Agriculture has maintained an aggressive import exclusion and surveillance program, coupled with steps to eliminate recycling of ruminant byproducts through the mammalian food chain, which is how BSE is transmitted from cow to cow.

The full impact of TSEs in the United States and around the world has yet to be determined. But the need for solid scientific information about transmission and pathology of prion-related diseases is critical. Many questions remain, including the actual cause and mechanisms of disease, why some TSEs are infectious while others are not, and why certain animal species are susceptible to some strains while others are resistant.

Much of the ARS research on TSEs will go to provide support for the agencies that must directly respond to the issue, in this case APHIS-NVSL and USDA's Food Safety and Inspection Service. The regulations and policies these agencies write to deal with TSEs can only be as good and as focused as the scientific information on which they are based.

ARS already has a special depth of expertise in prion-related research. The agency developed the test used by APHIS-NVSL to identify the first BSE case. From its work on scrapie, the TSE that mainly afflicts sheep, ARS developed the first practical

live-animal test for scrapie as well as techniques for identifying preclinical infected sheep over age 18 months at slaughter. This technology has been transferred to APHIS, and the antibodies are commercially available.

There is a vital need for better diagnostic tests for BSE and other TSEs, especially sensitive and reliable live-animal tests that can pick up abnormal prions before onset of clinical signs. ARS scientists are working on ultra-sensitive detection assays that can be applied to food, diagnostic samples, or the environment to learn more about the epidemiology and biology of TSEs.

ARS is also researching the evolution of new and emerging TSE strains and evaluating transmissibility among different species. There's a critical need for innovative methods of rapid strain typing to differentiate various TSEs. ARS already has the only TSE-dedicated biocontainment facility in the United States, which allows long-term research on the large animals most affected by these diseases—cattle, deer, and elk. Other laboratories depend on mice studies because they're unable to house livestock or wildlife for the long incubation needed.

Our expanding TSE research program integrates teams of veterinary clinicians, pathologists, protein chemists, and TSE specialists in a national, coordinated effort in pathobiology, diagnostic discovery, and intervention. Success in any of these areas will speed progress of the entire research program.

ARS is also working with scientists at the Institutes of Animal Health in Compton, England, and Edinburgh, Scotland, and the Veterinary Laboratories Agency in Weybridge, England, where BSE pathobiology studies have been occurring for years.

And we're collaborating with the University of Santiago, Spain, to study ways to differentiate normal prion proteins from abnormal ones; the University of California-San Francisco to improve current antibody-based diagnostic methods; the University of Washington to breed mice that are more susceptible to chronic wasting disease, the TSE now spreading in U.S. deer and elk; and Colorado State University to develop a prototype diagnostic test for preclinical infected free-ranging deer. The test is currently being used in surveillance efforts, and it's being adapted to a 1-day assay.

USDA remains confident in the safety of the U.S. food supply. With elimination of specific risk materials from the food chain and an active surveillance program, the risk to human health from BSE is extremely low. But ARS continues to pursue significant scientific knowledge and research that will be vital to the control and eradication of TSEs as an agricultural and public health threat.

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